Dual-RICH update 2-15-2016

- Magnetic field effect comparisons:

  - semi-analytical vs gemc + inverse ray tracing algorithm

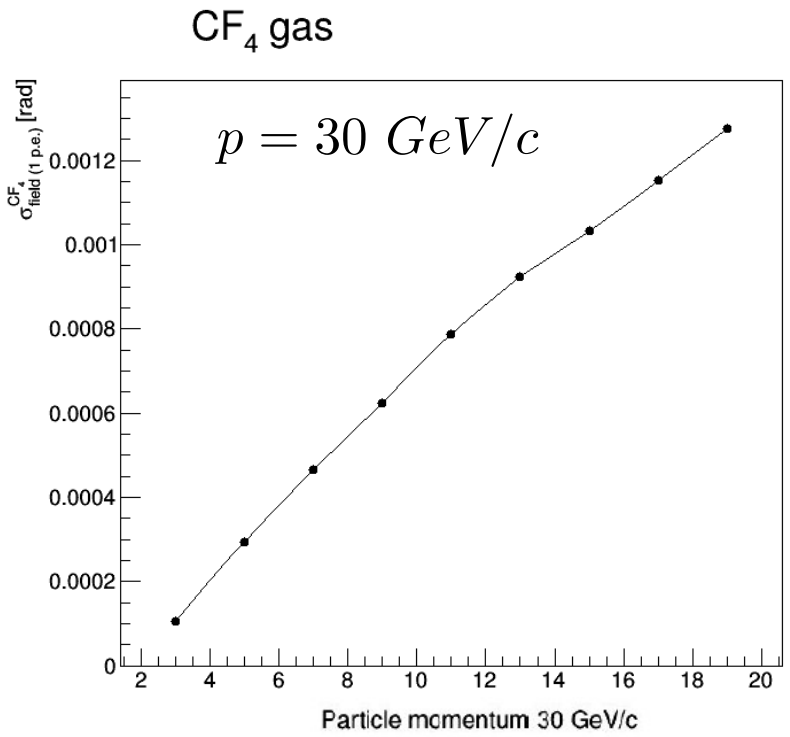
- Focal position and focal plane shaping

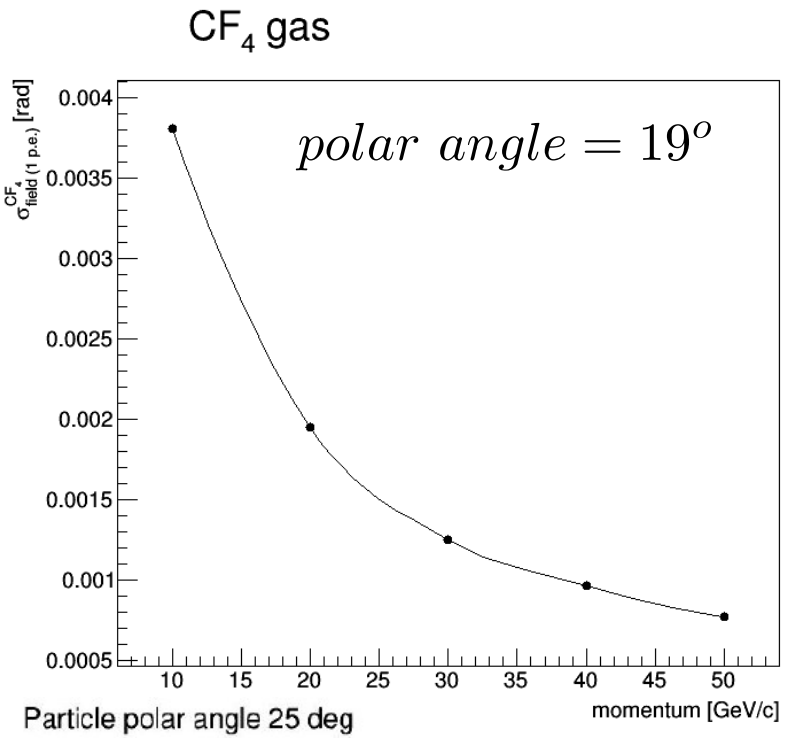
  - The method presented in

  Križan Peter and Marko Starič. "The optimal detector surface of a fixed target RICH with a tilte mirror." NIM A 379.1 (1996): 124-129.

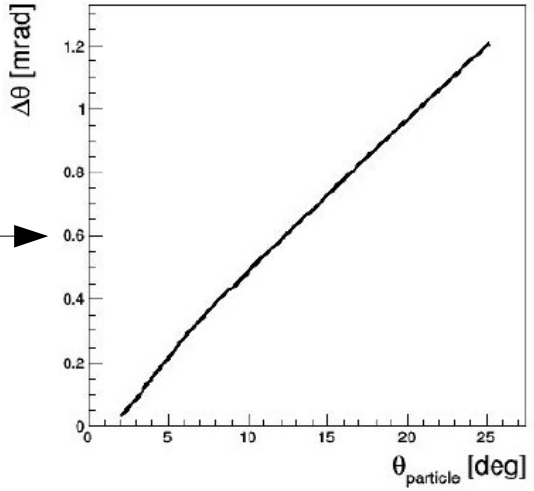
  has been partially followed.

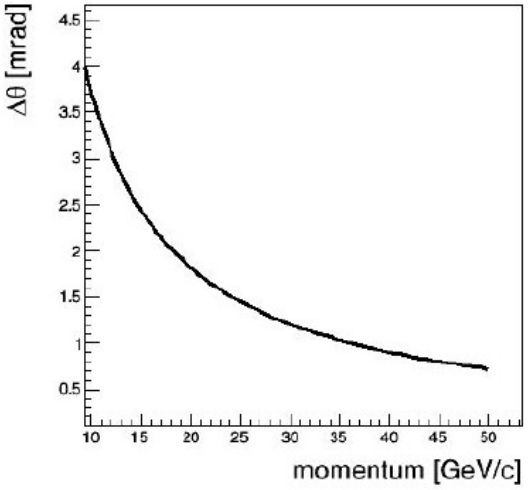
Field effects - gemc





Semi-analytic →

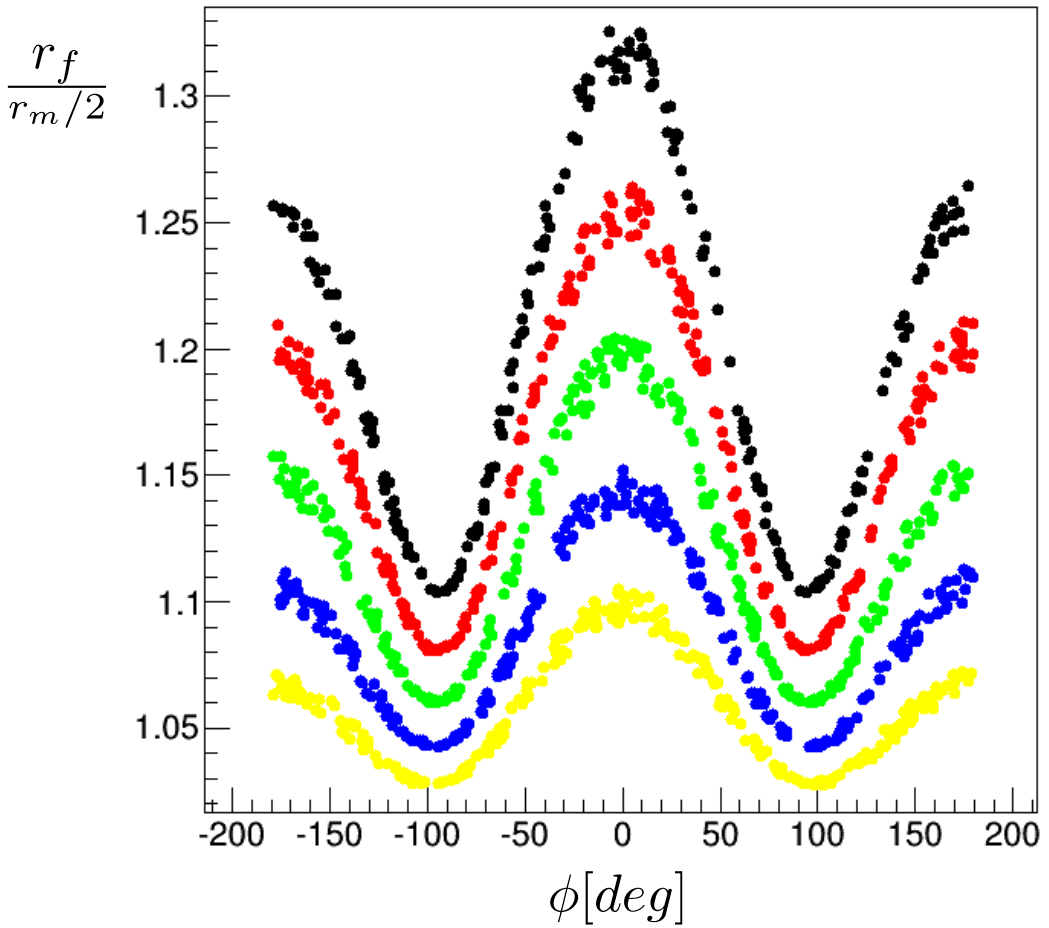




Focal plane position – CF4 gas

Track polar angle

θ = 5°
θ = 10°
θ = 15°
θ = 20°
θ = 25°



Position of the focal r_f with respect to the "naive" sphere $r_m/2$

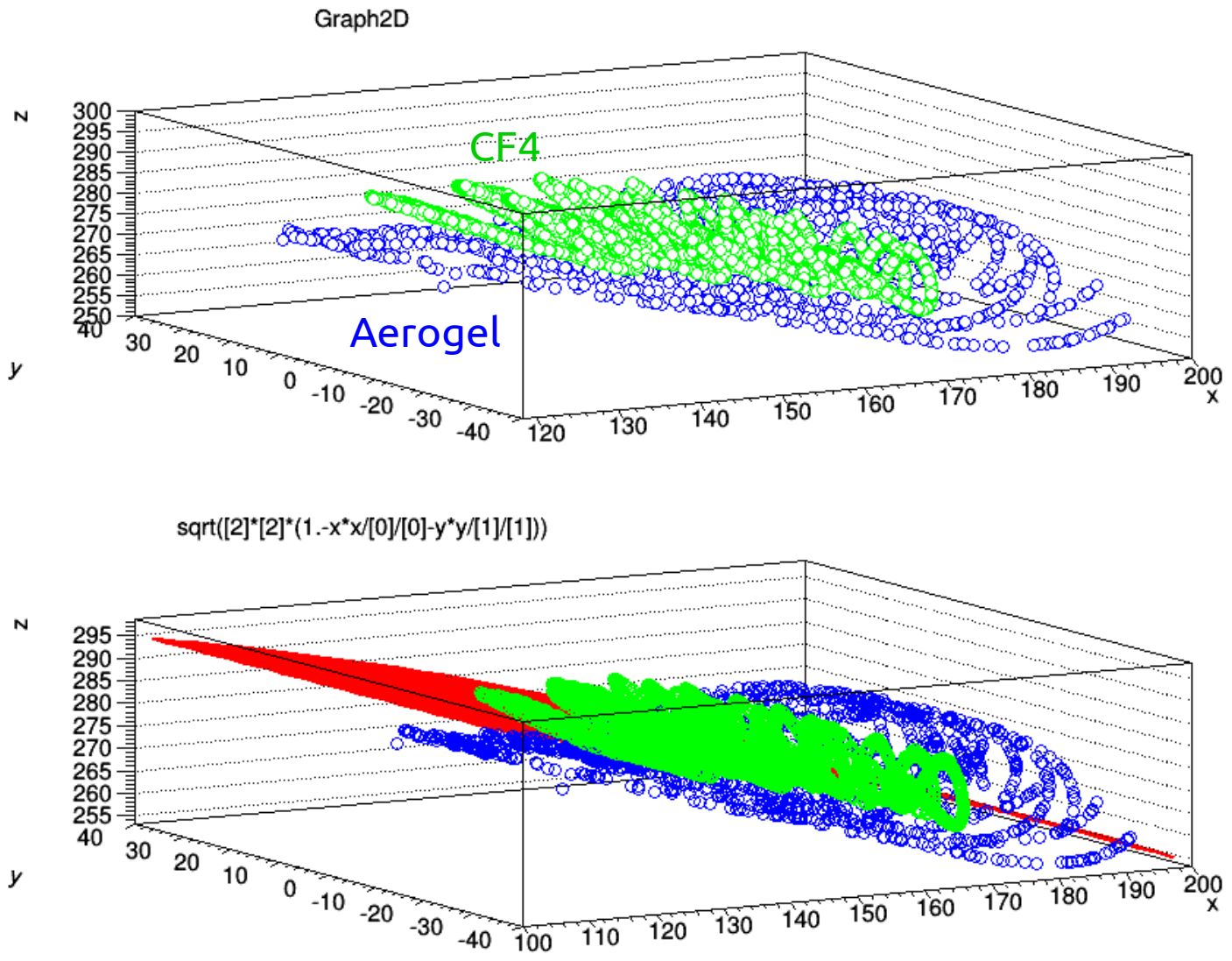
Mirror tilt angle: 27°

Mirror radius:

$r_m = 280\ cm$

Azhimutal angle of the photons with respect to the track direction

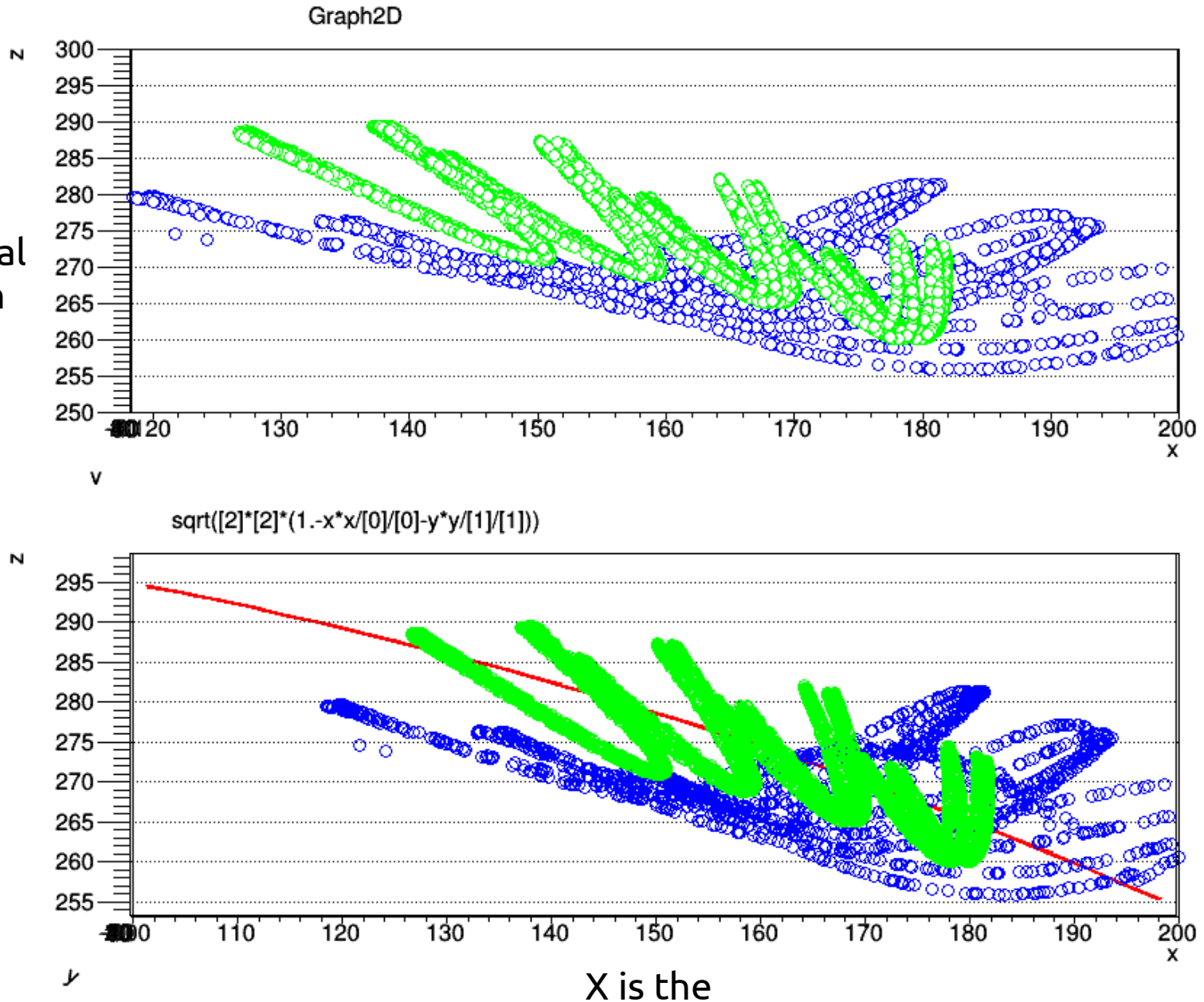
Focal plane shape – one sector



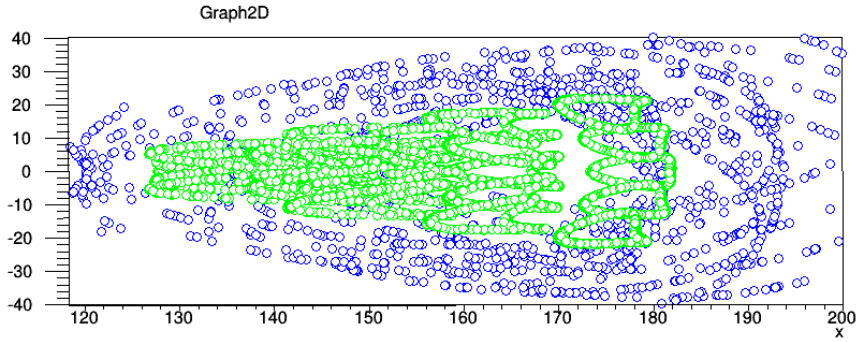
polar angle
[3°,25°]

Focal “plane” fitted with an ellipsoid (in red)

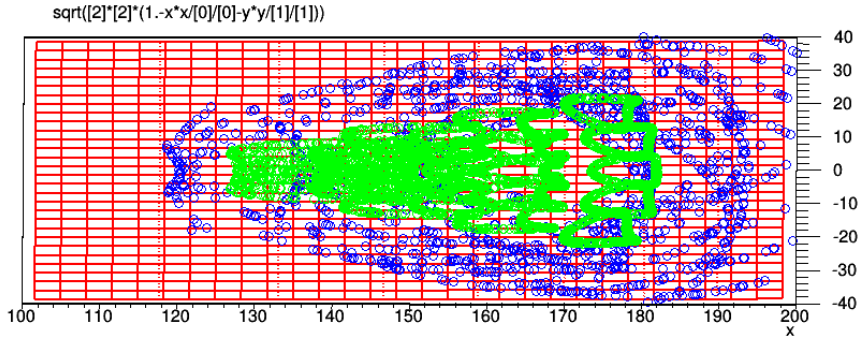
Z is the horizontal direction

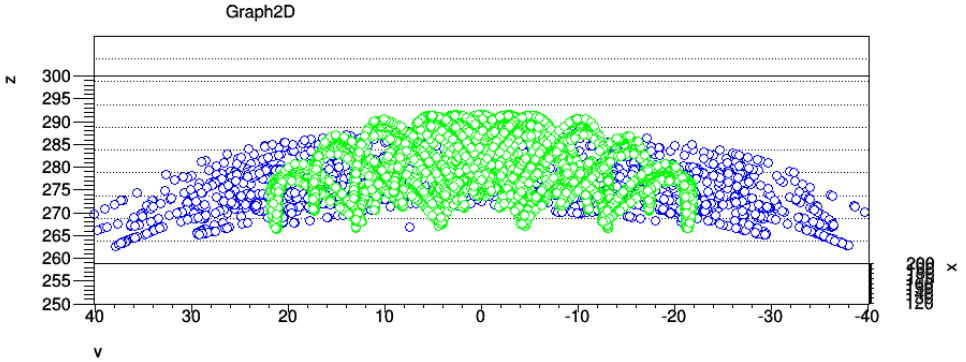


X is the detctor height

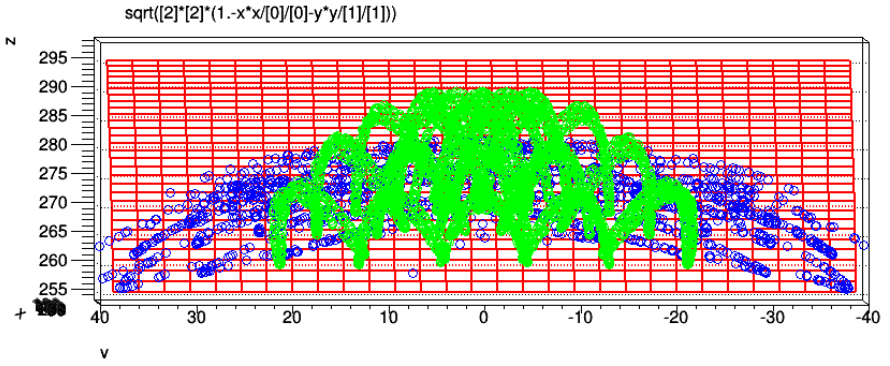


X-Y wiev





Y-Z wiev



To do next

- Continue to search for optimal smooth detector surface

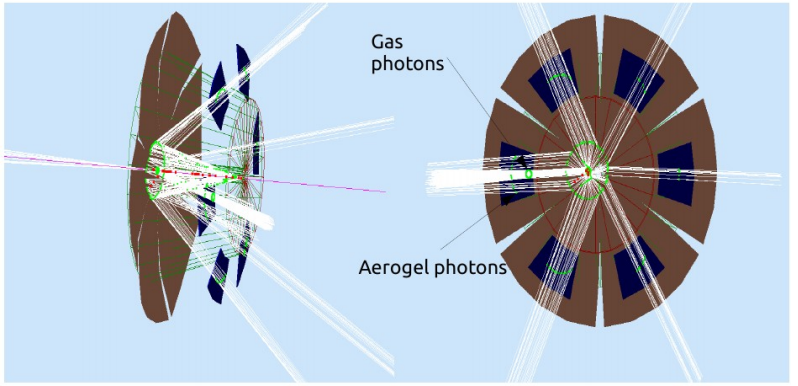
  - best fit of some “reasonable” funcion

  - implementation of the surface in gemc

  - test of the emission error on the reconstructed cherenkov angle

Dual-radiator RICH GEANT4/gemc simulation

Aerogel		CF_4 *gas*	
Errors on θc	mrad	Errors on θc	mrad
Chromatic	2.4	Chromatic	0.6
Emission	0.5 – 0.1	Emission	1.3 – 0.3
Pixel size (3 mm)	0.6	Pixel size (3 mm)	0.6
σtot	2.5	σtot	1.6
Npe	~ 10	Npe	~ 20



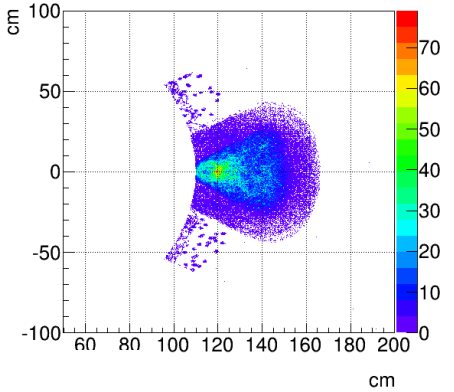
Two options of configuration under study:

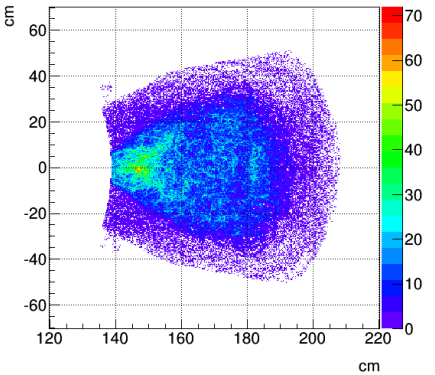
Momentum independent error contributions (1 p.e.), disentangled using the GEANT simulated data
In combination with the inverse ray tracing reconstruction algorithm developed and used for the HERMES experiment dual-radiator RICH

Magnetic field and track smearing to be added

The emission error contribution depends on the polar angle of the emitting track
and on the position/shape of the photodetector plane, namely it depends on the distance of the detector plane from the focus of the mirror at a given polar angle --> solutions to minimize the error range under study

Polar angle coverage up to 21° -->smaller detector size





Polar angle coverage up to 25° -->increased detector size